

Typology of agro-pastoralists and animal feeding practices under agro-ecological framework in the Guiriko region, western Burkina Faso

Idrissa Zoromé¹, Salimata Pousga^{1, 2*}, Boko Michel Orounladji², Souleymane Sanogo²

¹ Nazi Boni University, Bobo-Dioulasso, Burkina Faso

² International Center for Research and Development on Livestock in Subhumid Zone, Bobo-Dioulasso, Burkina Faso

* Corresponding author: pousgasalimata@yahoo.fr

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Abstract— In ruminant production systems, several strategies and practices are adopted coping with forage deficits. This study aimed to identify these strategies and analyze the agricultural practices implemented on agro-pastoral farms. It was conducted among 287 agro-pastoralists. Data were processed using R and SPSS software. The results revealed three categories of agro-pastoralists: small-scale, medium-scale, and large-scale. Small-scale agro-pastoralists mainly use fields (77%) and fallow land (64%) to feed their animals. In response to forage deficits, they store crop residues (73%). For crop production, they rely on animal traction (71%) and apply organic manure (54%). Medium-scale agro-pastoralists exploit fields (82%) and pasture areas (55%) to feed their animals. Faced with feed constraints, they store crop residues (77%), use feed supplements (68%), exploit spontaneous fodder trees on rangelands (59%), and reduce herd size (55%). In crop production, they use animal traction (91%), apply organic manure (77%), and practice rotational penning (55%). Large-scale agro-pastoralists use fields (89%), lowlands (56%), and grazing areas (56%) for livestock feeding. They store crop residues (86%), practice supplementation (59%), exploit spontaneous fodder trees on rangelands (53%), cultivate fodder crops (51%), and mow and store natural fodder (50%). In crop production, they use animal traction (89%), practice rotational penning (76%), and apply organic manure (69%). This study identified the strategies adopted by agro-pastoralists to ensure ruminants feeding. To improve these production systems, we recommend prioritizing agroecological practices such as legume fodder crop cultivation, along with better management of crop and animal by-products, for a better sustainable agro pastoral production.

Keywords— Agroecological practicewords, agro-pastoral, animal feeding, fodder crop cultivation, production systems.

I. INTRODUCTION

In Burkina Faso, ruminant livestock farming represents a major component of the agricultural sector, with an estimated 10.651 million cattle, 11.752 million sheep, and 17.597 million goats recorded in 2022 [1]. Production systems are predominantly extensive and agro-pastoral, relying on herd mobility and seasonal transhumance [2]. Natural rangelands constitute the primary feed resource, supporting more than 80% of livestock farmers, providing approximately 75% of total animal feed, and contributing to

nearly 95% of national milk production [1]. Consequently, livestock productivity remains closely linked to the availability, quality, and seasonal balance of forage resources [3]. Despite its economic and social importance, the sector faces increasing structural constraints. Spatio-temporal variability in forage availability constitutes the principal limitation to livestock productivity [4]. Progressive land-use changes (including agricultural expansion, urbanization, and mining development) combined with the intensifying effects of climate change, accelerating the degradation and fragmentation of grazing

areas while reducing fodder and water availability [5]. These dynamics compel herds to exploit increasingly marginal and nutritionally inadequate pastures [6].

The situation is further compounded by persistent insecurity, which restricts mobility, disrupts transhumance corridors, and heightens pressure on accessible grazing zones [5]. The cumulative effects of ecological stressors, demographic pressure, and security instability contribute to recurrent food crises, livestock losses, and escalating conflicts between herders and other natural resource users, thereby undermining rural livelihoods and social cohesion [7]. In response, agro-pastoral households increasingly rely on locally available adaptive strategies to sustain herd feeding under conditions of chronic fodder deficit [8]. Within this context of compounded environmental and socio-political pressures, a critical knowledge gap persists regarding the diversity of herd feeding systems and the adaptive strategies implemented at farm level. Understanding how agro-pastoral systems reorganize feed resources, integrate crop–livestock interactions, and adjust management practices is essential for designing sustainable interventions.

This study therefore aims to (i) develop a typology of ruminant production systems, (ii) identify and analyze the feeding strategies and agricultural practices implemented to cope with fodder deficits, and (iii) propose evidence-based recommendations to enhance the resilience, sustainability, and adaptive capacity of livestock farming systems.

II. MATERIAL AND METHODS

2.1 Study area

The study was conducted in western Burkina Faso, in the Hauts-Bassins Region (Houet Province). It covered the communes of Bobo-Dioulasso, Bama, Péni, and Satiri, all located within a radius of approximately 35 km from the city of Bobo-Dioulasso (Fig. 1). Houet Province belongs to the South-Sudanian climatic zone [9].

The area is characterized by two distinct seasons: a dry season lasting approximately seven months and a rainy season lasting about five months. Annual rainfall is relatively abundant, ranging between 800 and 1,100 mm. The rainy season extends from June to October, with August being the wettest month. The dry season is subdivided into a cool dry period (November to February) and a hot dry period (March to May), with April being the hottest month of the year.

The soils are predominantly tropical, ferruginous and hydromorphic, with sandy-clayey, sandy-silty, and sandy-loamy textures [10]. The dominant woody species include *Parkia biglobosa* Jacq., *Detarium microcarpum*

Guill. & Perr., *Vitellaria paradoxa* C.F. Gaertn., *Gmelina arborea* Roxb., *Khaya senegalensis* A. Juss., and *Tamarindus indica* L. Herbaceous vegetation mainly consists of *Andropogon* spp., *Indigofera* spp., *Loudetia togoensis* Pilg., *Eragrostis tremula* Hochst., *Urochloa* spp., and *Cyperus* spp. [11].

The dominant livestock production system is agro-pastoral, integrating crops and livestock farming [12]. However, small-scale semi-intensive farms are increasingly being established in the peri-urban areas of Bobo-Dioulasso.

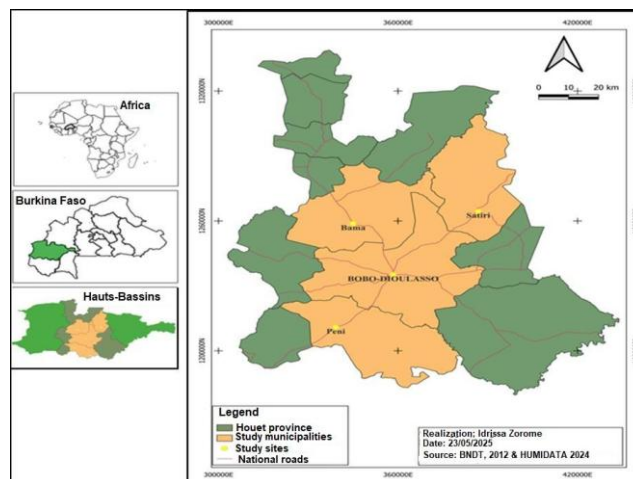


Fig.1: Map of the study area

2.2. Sampling

The survey involved a total of 287 large-ruminant agro-pastoralists of 18 villages across the municipalities of Bama, Bobo-Dioulasso, Péni, and Satiri. At the local level, agro-pastoralists were randomly selected from producer organizations with the support of the departmental animal resources services of the government.

2.3. Data Collection

Data were collected from agro-pastoralists using a structured, single-pass questionnaire developed with a digital tool covering several variables. The questionnaire was administered via smartphones using the ODK Collect application, and responses were recorded on the Kobo Toolbox platform, ensuring efficient and secure data management. Data collection was carried out through individual interviews with respondents.

2.4. Data analysis

A typology of agro-pastoralists was established using multivariate analyses performed with R software (version 4.4.1) (R Core Team, 2024). A principal component analysis (PCA) was conducted based on 15 variables, including six structural variables, five operational variables, and four performance variables (TABLE I).

Subsequently, a hierarchical ascending classification (HAC) was performed using the factorial coordinates of individuals on the first three principal component axes. This procedure enabled the identification of three distinct categories of agro-pastoralists. Differences among the three categories were assessed for each PCA variable using the Kruskal–Wallis test at a 5% significance level. The frequencies of qualitative variables (namely types of pastures used, strategies adopted to cope with fodder deficits, and fodder species cultivated) were calculated for each category and compared using the Chi-square test. Data related to feed types and agricultural practices were analyzed descriptively using IBM SPSS Statistics (version 22). Stacked histograms were generated using Python (version 3.12) with the Matplotlib and Pandas libraries.

Table 1: Variables retained for multivariate analyses

Variables	Unit	Calculation methods	Justification in the analysis
Cattle population	TLU	$\Sigma(\text{Cattle population}) \times 0,7$	The herd size influences the quantities of feed to be stored and strategies adopted in response to feeding difficulties
Number of milked cows	Cow	$\Sigma(\text{milked cows from the farm})$	The number of milked cows influences the quantities of feed to be stored, milk production
Cultivated area	ha	$\Sigma(\text{All cultivated areas})$	The cultivated area affects the availability of crop residues and the duration of their use
Knowledge of fodder crops	%	$\frac{\Sigma(\text{producers familiar with fodder crops})}{\text{Total number of producers}}$	Knowledge of fodder crops facilitates their adoption and fodder production on the farm
Establishment of fodder crops	%	$\frac{\Sigma(\text{producers familiar who have established})}{\text{Total number of producers}}$	The establishment of fodder crops indicates the level of adoption of these crops by agro-pastoralists
Area of fodder crops	ha	$\Sigma(\text{area of fodder crops})$	The area sown to fodder crops determines the fodder production capacity
Proportion of fodder crops	%	$\frac{\text{area of fodder crops}}{\text{Total cultivated area}} \times 100$	The share of area dedicated to fodder crops shows the importance given to fodder crops in the farm
Duration of use of crop residues per year	Day	$\Sigma(\text{Days of use of crop residues})$	The duration of crop residue use indicates the capacity to cope with feed deficits
Number of jobs created	employee	$\Sigma(\text{People employed})$	The number of jobs created highlights the socio-economic importance of the farm
Milk yield per cow per day in the dry season	Liter	$\frac{\text{Total quantity of milk produced in the dry season}}{\text{Number of cows milked in the dry season}}$	The quantity of milk produced per cow in the dry season measures the farm's production level during this period
Proportion of milk self-consumed in the dry season	%	$\frac{\text{Quantity self - consumed in the dry season}}{\text{Quantity produced in the dry season}}$	The share of self-consumed milk in the dry season provides information on the balance between self-consumed and marketed production.
Dry Season income from milk sales	FCFA	Quantity sold x price per liter	The milk income dry season measures the level of farm income during the dry season
Milk yield per cow per day in the rainy season	Liter	$\frac{\text{Total quantity of milk produced in the rainy season}}{\text{Number of cows milked in the rainy season}}$	The quantity of milk produced per cow in the rainy season measures the farm's production level during this period.
Proportion of milk self-consumed in the rainy season	%	$\frac{\text{Quantity self - consumed in the rainy season}}{\text{Quantity produced in the rainy season}}$	The share of self-consumed milk provides information on the proportions of self-consumed and sold production
Rainy Season income from milk sales	FCFA	Quantity sold x price per liter	milk income (rainy season) measures the level of farm income during the rainy season

TLU: Tropical Livestock Unit (1 bovine of 250 kg live weight); ha: hectare; %: percentage; 1 USD =565 FCFA

III. RESULTS

3.1. Typology of surveyed farms

Based on the selected variables, the hierarchical ascending classification on the principal components (PCA) revealed three categories of agro-pastoralists: Cluster 1 = Small-scale Agro-Pastoralists (SAP), Cluster 2 = Large-scale Agro-

Pastoralists (LAP), and Cluster 3 = Medium-scale Agro-Pastoralists (MAP). These categories are distinguished in western Burkina Faso by their cattle breeding and fodder crop production practices (Fig. 2).

3.2. Diversity of farms regarding variables of interest.

TABLE II presents the similarities and differences among the agro-pastoralist categories revealed by the PCA (Figure 2). The three categories are clearly distinguished ($p < 0.05$) by the size of their cattle herds. Small-scale agro-pastoralists have 9.8 Tropical Livestock Unit (TLU), medium-scale agro-pastoralists have 25.4 TLU, and large-scale agro-pastoralists have 49.7 TLU. The number of milked cows is significantly higher among large-scale agro-pastoralists (13 cows) compared to small-scale and medium-scale agro-pastoralists, who each have 6 cows. Large-scale agro-pastoralists (91%) also have significantly more knowledge about fodder crops than medium-scale (64%) and small-scale (36%) farmers ($p < 0.05$). Regarding the establishment of fodder crops, 56% of large-scale agro-pastoralists have established them, compared to 46% of medium-scale and 3% of small-scale farmers. Large-scale agro-pastoralists create on average 3 jobs, while medium-scale and small-scale farmers create 2 and 0 jobs, respectively ($p < 0.05$).

The quantities of milk produced per cow per day in the dry season are similar ($p > 0.05$) for small-scale and large-scale agro-pastoralists, at 0.5 l/day and 0.6 l/day, respectively. These values are significantly lower ($p < 0.05$) than the 2.2 l/day produced by cows of medium-scale agro-pastoralists. The shares of self-consumed milk in the dry season differ significantly among small-scale, medium-scale, and large-scale agro-pastoralists ($p < 0.05$), at 60%, 25%, and 32%, respectively. Daily income from milk sales during the dry season also differs significantly ($p < 0.05$) among the three categories. Medium-scale agro-pastoralists earn the highest income (3,781 CFA francs), followed by large (2,002 CFA francs) and small-scale agro-pastoralists (358 CFA francs).

In the rainy season, the quantities of milk produced per cow per day are similar ($p > 0.05$) for small-scale and large-scale agro-pastoralists, averaging 1 l/day per cow. These quantities are significantly lower ($p < 0.05$) than the 3 l/day produced per cow by medium-scale agro-pastoralists. The shares of self-consumed milk are similar ($p > 0.05$) between medium-scale and large-scale agro-pastoralists, at 26% and 27%, respectively, and significantly lower ($p < 0.05$) than the 55% observed among small-scale agro-pastoralists. Rainy-season income also differs significantly ($p < 0.05$) among the three categories, with medium-scale agro-pastoralists earning the highest income

(4,127 CFA francs), followed by large (2,389 CFA francs) and small-scale agro-pastoralists (489 CFA francs).

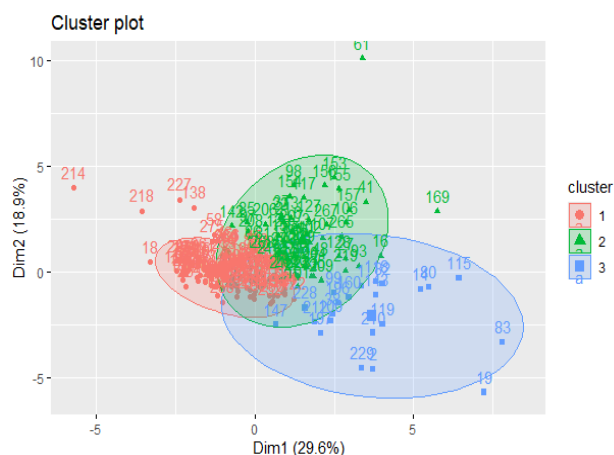


Fig.2: Scatter plots showing the three categories of agro-pastoralists in the plane of factorial

Table 2: Diversity of farms regarding variables of interest.

Variables	Unit	Mean	Median	SAP	MAP
Number of farms by category				195	22
Cattle population	UBT	20,7	10,5	9,8 ± 1 ^a	25,4 ± 4,1 ^b
Number of cows milked	Cow	9	7	6 ± 1 ^a	6 ± 1 ^a
Cultivated area	ha	3,4	2	3,6 ± 0,3	2,4 ± 0,5
Knowledge of fodder crops	%	52	100	36 ± 3 ^a	64 ± 11 ^b
Establishment of fodder crops	%	19	0	3 ± 1 ^a	46 ± 11 ^b
Area of fodder crops	ha	0,8	0,5	0,7 ± 0,2	0,7 ± 0,1
Proportion of fodder crops	%	13	13	9 ± 2	10 ± 3
Duration of crop residue use per year	Jour	70	60	69 ± 4	70 ± 8
Number of jobs created	Employee	1	0	0 ± 0 ^a	2 ± 1 ^b
Milk yield per cow per day in the dry season	Liter	0,8	0,6	0,5 ± 0 ^a	2,2 ± 0,2 ^b
Proportion of milk self-consumed in the dry season	%	44	33	60 ± 5 ^c	25 ± 2 ^a
Income from milk sales per day in the dry season	FCFA	1967	400	358 ± 43 ^a	3782 ± 559 ^c
Milk yield per cow per day in the rainy season	Liter	1,3	1	0,9 ± 0,1 ^a	3,1 ± 0,4 ^b
Proportion of milk self-consumed in the rainy season	%	41	30	55 ± 7 ^b	26 ± 3 ^a
Income from milk sales per day in the rainy season	FCFA	2181	800	489 ± 57 ^a	4127 ± 533 ^c

SAP = Small-scale Agro-Pastoralists, LAP = Large-scale Agro-Pastoralists, MAP = Medium-scale Agro-Pastoralists

TLU: Tropical Livestock Unit (1 bovine of 250 kg live weight); ha: hectare; %: percentage; 1 USD =565 FCFA; a,b,c: Values assigned different letters on the same line are statistically different

3.3. Types of pasture used

Fields in common pastures (80%) and fallow lands (53%) are the most exploited pasture types by agro-pastoralists (Table III). Small-scale agro-pastoralists (64%) exploit fallow lands significantly more ($p < 0.05$) than medium-

scale (32%) and large-scale agro-pastoralists (30%). Areas dedicated to grazing are used more by medium-scale (55%) and large-scale (56%) agro-pastoralists than by small-scale agro-pastoralists (22%). Lowlands are exploited by 56% of large-scale, 41% of medium-scale, and 25% of small-scale agro-pastoralists ($p < 0.05$). Plantations (14%), transhumance corridors (12%), and forests (9%) are rarely visited by agro-pastoralists to feeding.

Table 3: Types of pasture used

Variables	SAP (%)	MAP (%)	LAP (%)	Overall (%)	χ^2	p -value
Fallow	64 ^b	32 ^a	30 ^a	53	28,489	<0,001
Transhumance corridor	7 ^a	18 ^b	23 ^b	12	13,039	<0,001
Grazing area	22 ^a	55 ^b	56 ^b	32	32,799	<0,001
Planting	12	14	17	14	1,026	0,599
Shallow	25 ^a	41 ^b	56 ^c	33	22,974	<0,001
Fields	77	82	89	80	4,433	0,109
Forest	9	14	7	9	0,888	0,642

SAP = Small-scale Agro-Pastoralists, LAP = Large-scale Agro-Pastoralists, MAP = Medium-scale Agro-Pastoralists
a,b,c: The values assigned to different letters on the same line are statistically different.

3.4. Strategies adopted to address fodder deficits

To cope with fodder deficits, agro-pastoralists (76%) primarily rely on crop residues (TABLE. IV). To a lesser extent, they adopt strategies such as feed supplementation (37%), herd reduction (35%), woody fodder harvesting (33%), natural fodder harvesting (23%), and fodder cultivating (19%). Large-scale agro-pastoralists are characterized using crop residues (86%), feed supplementation (59%), exploitation of woody fodder on rangelands (53%), production of fodder crops (51%), and mowing and conservation of natural fodder (50%). Medium-scale agro-pastoralists, in addition to using crop residues (77%), feed supplementation (68%), and woody fodder (59%), also reduce the size of their cattle herds (55%) and practice mowing and conservation of natural fodder as well as production of fodder crops. Small-scale agro-pastoralists rely primarily on crop residues (73%) to cope with fodder deficits.

Table 4 : Strategies adopted to deal with fodder deficits

Variables	SAP (%)	MAP (%)	LAP (%)	Total (%)	χ^2	p-value
Herd reduction	31 ^a	55 ^b	39 ^a	35	5,279	0,041
Herd division	5 ^a	9 ^b	17 ^b	8	9,720	<0,008
Fodder crop	5 ^a	36 ^b	51 ^c	19	77,092	<0,001
Transhumance	8 ^a	14 ^b	34 ^c	15	29,179	<0,001
Food supplementation	26 ^a	68 ^c	59 ^b	37	33,969	<0,001
Outdoor pasture	9 ^a	27 ^b	31 ^b	16	22,517	<0,001
Fallow	14 ^a	5 ^a	6 ^a	11	4,487	0,106
Woody Forage	23 ^a	59 ^b	53 ^b	33	27,897	<0,001
Natural fodder stock	10 ^a	46 ^b	50 ^b	23	53,517	<0,001
Pastures in protected areas	0 ^a	0 ^a	4 ^b	1	9,398	<0,009
Herd diversification	1 ^a	0 ^a	1 ^a	1	0,791	0,673
Crop residue Storage	73 ^a	77 ^a	86 ^a	76	4,749	0,093
Grazing in the fields	20 ^a	27 ^a	12 ^a	18	5,592	0,166
Others	11 ^b	0 ^a	0 ^a	7,3	10,690	<0,005

SAP = Small-scale Agro-Pastoralists, LAP = Large-scale Agro-Pastoralists, MAP = Medium-scale Agro-Pastoralists

a,b,c : The values affected to different letters on the same line are statistically different.

3.5. On farms agricultural practices

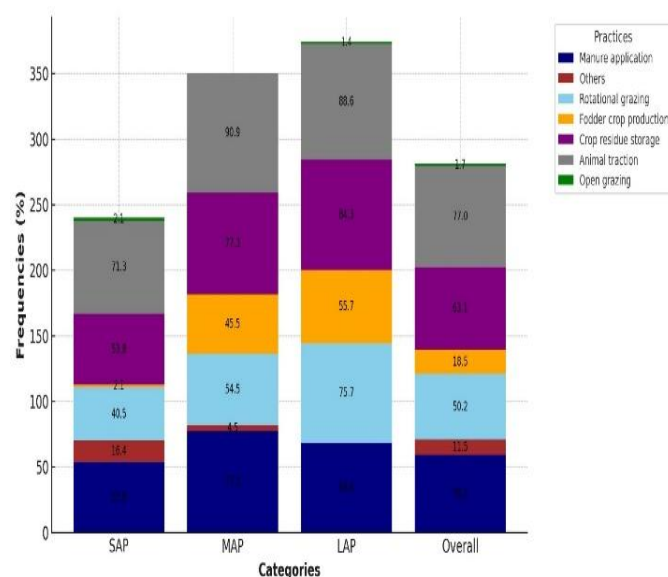


Fig.3: On farms agricultural practices implemented

SAP = Small-scale Agro-Pastoralists, MAP = Medium-scale Agro-Pastoralists, LAP = Large-scale Agro-Pastoralists,

The analysis of Fig. 3 shows that several forms of agriculture-livestock integration exist among the surveyed agro-pastoralists. The most common practices implemented are animal traction (77%), crop residue storage (63%), application of organic manure (59%), and rotational

penning (50%). On small-scale agro-pastoral farms, the most widely implemented practices are animal traction (71%), organic manure (54%), and crop residue storage (54%). Medium-scale agro-pastoralists more frequently use animal traction (91%), organic manure (77%), crop residue storage (77%), and rotational penning (55%). Among large-scale agro-pastoralists, the most widely adopted forms of crop-livestock integration are animal traction (89%), crop residue storage (84%), rotational penning (76%), organic manure (69%), and fodder crop production (56%).

IV. DISCUSSION

4.1. Diversity of production systems

The analysis of the distribution of agro-pastoralists based on the considered variables, allowed the identification of the characteristics of their three categories. Several parameters differentiate these categories: cattle herd size, number of milked cows, knowledge and establishment of fodder crops, number of jobs created, dairy performance per cow, level of self-dairy consumption, and daily income from dairy products sales.

Category 1: Small-scale agro-pastoralists consists of 195 agro-pastoralists, representing 68% of the sample. They are mainly indigenous residents in the study area and some non-native agro-pastoralists who settled in the region to benefit from its enormous agricultural potential. They cultivate at least 3.5 ha of land and have limited knowledge of fodder crops. With small cattle herds, they primarily feed their animals with crop residues from their farms rather than relying on grazing. According to [13], these are extensive livestock farms based on draft oxen with small breeding groups. Labor for animal care and fieldwork is mainly family-based, though herds are often entrusted to a Peulh shepherd under the owner's supervision, and transhumance is generally not practiced [14].

Category 2: Medium-scale agro-pastoralists includes 22 agro-pastoralists, representing 8% of the sample. These farmers manage larger herds (25 TLU, including 6 milking cows) to optimize milk production. Milking cows produce 2.2 l/day in the dry season and 3 l/day in the rainy season. Most are in the communes surrounding Bobo-Dioulasso and are affiliated with dairy collection centers [15]. The development of these centers has encouraged medium-scale agro-pastoralists to intensify dairy production and position themselves as commercial dairy producers. As noted by Hiernaux et al. [3], they can be described as opportunistic livestock farmers. Unlike small-scale agro-pastoralists, medium-scale farmers produce primarily for sale rather than self-consumption.

Category 3: Large-scale agro-pastoralists comprises 70 farmers, or 24% of the sample, mostly non-natives. These agro-pastoralists have a strong livestock orientation and access to arable land. Their herds are mainly females, as males are sold except for breeding stock, while females are kept for reproduction until the end of their reproductive career before being sold as culled cows [3]. Dairy production is secondary and carefully managed so as not to hinder calf growth, which remains the primary objective [16]. Milk and its derivatives are largely intended for family consumption, with partial sales reserved for women due to their social role [17]. Large herds also serve as a marker of economic status and social prestige [14]. These farmers are familiar with fodder crops but produce little, as most of their agricultural production focuses on other crops. The quantities of stored fodder are insufficient to meet animal needs or to improve production, and expenditures on breeding remain moderate [13]

4.2. Strategies implemented by agro-pastoralists to respond to fodder deficits on farms

The analysis of pasture use shows that respondents primarily rely on common pastures, regardless of their category. This use is supplemented by fallow lands for small-scale farmers, grazing areas for medium-scale farmers, and both grazing areas and lowlands for large-scale agro-pastoralists. These findings are consistent with [3], who reported that most Sahelian livestock farms depend directly on rangeland fodder resources. In western Burkina Faso, grazing in fallow lands, lowlands, and forests results from the reduction of available grazing areas at the expense of cultivated fields. The primary feeding strategy remains the exploitation of natural rangelands and crop residues [18].

The use of these environments depends on the season. [19] showed that at the beginning of the rainy season, fast-growing areas such as lowlands are grazed while waiting for crops to establish; during the rainy season, fallow lands and hills are exploited; at the start of harvest, grazing occurs along lowlands and on early crop residues. During the cold dry season, grazing is mainly done in cultivated fields to benefit from plant co-products, whereas all environments are utilized during the hot dry season.

To cope with fodder deficits, agro-pastoralists primarily store crop residues for the dry season, a strategy mainly adopted by small-scale farmers. Medium- and large-scale agro-pastoralists adopt additional strategies, including feed supplementation based on agro-industrial by-products, exploitation of woody fodder, fodder cultivation, and mowing and storing natural fodder. However, fodder cultivation remains less common than the collection and conservation of crop residues and natural fodder ([8]; [20]).

Medium-scale agro-pastoralists also divide their herds to facilitate management and optimize milk production. Since they cannot meet the nutritional needs of the entire herd, feeding strategies target specific categories of animals, either to prepare draft oxen or to support young and weak animals during lean periods [18]. Livestock farmers affiliated with milk collection centres practice supplementation to sustain milk production [15] and are the only group that may reduce their herd to cope with food shortages. According to [18], herd division is a feeding strategy for large herds (150-250 heads) with a dairy production objective, involving splitting the herd into two or three groups sent on distant transhumance year-round while keeping a small herd (10-30 heads) composed mainly of dairy cows near the city.

4.3. Agricultural practices implemented on dairy farms

The analysis shows that agro-pastoralists integrate agriculture and livestock through agroecologically oriented agricultural practices. All agro-pastoralists, regardless of category, use animal traction in crop production, store crop residues for feeding animals, apply organic manure to fertilize their fields, and practice rotational penning. These results confirm [21], who highlighted the most widely implemented agricultural practices in agrosylvopastoral systems and the important role of agriculture-livestock integration in promoting the agroecological transition.

In addition to these practices, medium- and large-scale agro-pastoralists have introduced fodder crop production. This demonstrates that agriculture-livestock integration is actively implemented on farms. [22] also reported that while crop-livestock integration is practiced on all farms in western Burkina Faso, the degree and role of integration vary according to farm type. Producers combine agriculture and livestock by using animal traction and transport, manure, recovery of agricultural residues, and capitalization of agricultural surpluses in livestock production [22]. Research and development institutions, projects, and development programs have also promoted the integration of agriculture and livestock [13].

V. CONCLUSION

The study enabled the identification of agro-pastoralist typologies and their characteristics. Small-scale agro-pastoralists mainly use fallow lands and fields as grazing areas, and their primary strategy to cope with fodder deficits is the storage of crop residues. Medium-scale- and large-scale agro-pastoralists exploit additional grazing areas: medium-scale farmers use grazing areas, while large-scale farmers exploit lowlands. In addition, to storing crop residues, these farmers adopt several other strategies depending on their production objectives.

Then, results revealed that a significant portion of cultivated land is increasingly dedicated to fodder crops, averaging 0.8 ha, or 13% of the total cultivated area, across all agro-pastoralist categories.

Finally, all agro-pastoralists implement agroecological practices by integrating agriculture and livestock farming through the use of animals for traction, the collection of crop residues for animal feed, and the use of manure to fertilize fields. To improve the resilience of these systems, we propose prioritizing agroecological technologies, including fodder crop production and the sustainable management of crop and animal by-products on farms.

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REFERENCES

- [1] MARAH, 2021. Enquête nationale sur le cheptel (ENC1) de 2018. Rapport d'analyse. Burkina Faso. 190 P.
- [2] FAO : 2019. Le devenir de l'élevage au Burkina Faso. Défis et opportunités face aux incertitudes. Rome. 56 p.
- [3] Hiernaux P., Diawara M.O., Kergoat L., Mougin E., 2015. La contrainte fourragère des élevages pastoraux et agropastoraux du Sahel. Adaptations et perspectives. p39-59.
- [4] Toé A., Sanon H.O., Obulbige F., et Bougouma V.M.C., 2022. Amélioration du disponible fourrager par différents modes de cultures de sorgho et de niébé à double objectif. *Journal of Animal & Plant Sciences*. 54(1): 9808-9821 <https://doi.org/10.35759/JAnmPLSci.v54-1.2>
- [5] MARAH, 2022. Rapport de suivi et évaluation des ressources pastorales de la campagne agropastorale 2022-2023 au Burkina Faso. 55 P.
- [6] Sib O., Bougouma-Yameogo V.M.C., Blanchard M., Gonzalez-Garcia E., all E., 2017. Dairy production in Western Burkina Faso in a context of emergence of dairies: Diversity of breeding practices and proposals for improvement. *Rev. Elev. Méd. Vet. Pays Trop.*, 70 (3): 81-91, doi: 10.19182/remvt.31521
- [7] Orounladi, B. M., Sib O., Berre D., Assouma M. H., Dabire D., Sanogo S., Vall E., 2024. Cross-Examination of Agroecology and Viability in Agro-Sylvo-Pastoral Systems in Western Burkina Faso. *Agroecology and Sustainable Food Systems* 48 (4): 581 609. <https://doi.org/10.1080/21683565.2024.2307902> .
- [8] Kiema A., Sawadogo I., Ouédraogo T., Nianogo A.J., 2012. Stratégies d'exploitation du fourrage par les éleveurs de la zone sahélienne du Burkina Faso. *Int. J. Biol. Chem. Sci.* 6(4): 1492-1505.
- [9] Fontes J., et Guinko S., 1995, Carte de la végétation et de l'occupation du sol du Burkina Faso, Notes explicatives, Ouagadougou, 67p.
- [10] Bougma A., 2013. Effets des précédents culturels et des fumures sur la fertilité du sol et les rendements du riz pluvial. Mémoire de fin de cycle, Master en Sciences du Sol, Institut du Développement Rural (IDR), Université Polytechnique de Bobo-Dioulasso, Burkina Faso. 85 p.
- [11] Zampaligré N., Dossa L.H., Schlecht E., 2013. Contribution of browse to ruminant nutrition across three agro-ecological zones of Burkina Faso. *Journal of Arid Environments*. 95:55-64
- [12] Mulumba J. B., Somda J., Sanon Y. et Kagoné H., 2008. Elevage et marché régional au Sahel et en Afrique de l'Ouest : potentialités et défis. Club du Sahel et de l'Afrique de l'Ouest/OCDE, Paris, France, 163 p.
- [13] Coulibaly D., Ba A., Havard M., Vall E., 2019. Typologie des systèmes d'élevage dans la zone cotonnière du Mali. p. 173-187. In : Soumaré et Havard. Actes du colloque les zones cotonnières africaines, Dynamiques et durabilité, 21 au 23 novembre 2017, Bamako, Mali. Sur : <https://www.researchgate.net/publication/334697351>
- [14] Vall E., Dugué P., Blanchard M., 2006. Le tissage des relations agriculture-élevage au fil du coton. *Cahiers Agricultures*, 15 (1): 72-79.
- [15] Sodré E., Gnanda B. I., Ouédraogo S., Charles-Henri M., et Vall E., 2021. - Effets de rations de complémentation à base de fourrages cultivés sur la production laitière bovine de saison sèche et les revenus tirés du lait chez les éleveurs laitiers extensifs en zone soudanienne du Burkina Faso, In CNRST et U-AUBEN, 2021 : Actes du symposium International sur la Science et la Technologie (SIST) tenue du 15 au 19 novembre 2021 à Ouagadougou, Burkina Faso. 199p.
- [16] Zezza A., Federighi G., Adamou K., Hiernaux P., 2014. Milking the data: measuring income from milk production in extensive livestock systems. Experimental evidence from Niger. Policy Research Working Paper, 7114, World Bank, 32 p.
- [17] Querre M., 2003. Quand le lait devient enjeu social : le cas de la société peule dans le Séno (Burkina Faso) ». *Anthropology of food* URL. 11p. <http://aof.revues.org/324>
- [18] Coulibaly D., Moulin C.H., Pocard-Chappuis R., Morin G., Sidibé S.I., Corniaux C. 2007. Evolution des stratégies d'alimentation des élevages bovins dans le bassin d'approvisionnement en lait de la ville de Sikasso au Mali. *Revue Elev. Méd. vét. Pays trop.*, 2007, 60 (1-4) : 103-111
- [19] Vall E., Diallo M.A., Vigne M., Bénégabou I., Vayssières J., Ba A., Aimé L. Dongmo A.L., Blanchard M. 2014. Les facettes agro écologiques de l'élevage des ruminants en Afrique de l'Ouest et du Centre. Grain de sel n°63-66 - Agroécologie en Afrique de l'Ouest et du Centre. 5p
- [20] Vigne M., Vayssières, J., Lecomte P., Peyraud J.L., 2013. Pluri-energy analysis of livestock systems a comparison of dairy systems in different territories. *J. Environ. Manag.* 15 (126), 44-54.
- [21] Vall E, Orounladi B M, Berre D, Assouma M H, Dabiré D, Sanogo S, Sib O, 2023. Crop livestock synergies and by

products recycling: major factors for agroecology in West African agro sylvo pastoral systems. *Agronomy for Sustainable Development*, 43:70. <https://doi.org/10.1007/s13593-023-00908-6>

- [22] Vall E., Koutou M., Blanchard M., Coulibaly K., Diallo M. A., Andrieu N. 2012. Intégration agriculture-élevage et intensification écologique dans les systèmes agrosylvopastoraux de l'Ouest du Burkina Faso, province du Tuy. Partenariat, modélisation, expérimentations : quelles leçons pour la conception de l'innovation et l'intensification écologique ? Nov 2011, Bobo-Dioulasso, Burkina Faso. 12 p. hal-00718613. <https://hal.science/hal-00718613>